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Yamamoto

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(54) **ILLUMINATION DEVICE FOR VEHICLE HAVING ROTATABLE FIRST SHADE AND ONE PIECE COMPONENT WITH SHADES AND REFLECTOR DISPOSED IN FRONT OF FIRST SHADE**

(71) Applicant: **KOITO MANUFACTURING CO., LTD.**, Tokyo (JP)

(72) Inventor: **Teruaki Yamamoto**, Shizuoka (JP)

(73) Assignee: **KOITO MANUFACTURING CO., LTD.**, Tokyo (JP)

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See application file for complete search history.

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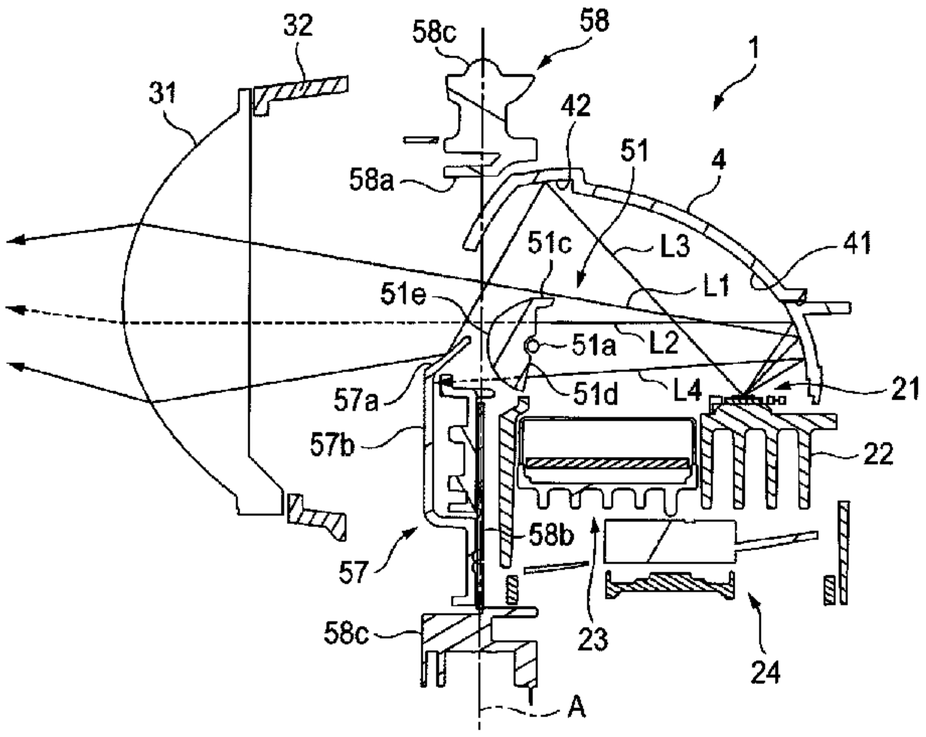
Primary Examiner — Robert May
(74) *Attorney, Agent, or Firm* — Osha Liang LLP

(57) **ABSTRACT**

An illumination device to be mounted on a vehicle includes a light source, an optical member, a holder, a first reflector, a first shade, a driving source, a power feeding member, a second reflector, a second shade, and a third shade. The second reflector is disposed between the optical member and the first shade and configured to reflect a part of the light reflected by the first reflector toward the optical member. The second shade is disposed between the optical member and the first shade so as to block a part of the light which is not blocked by the first shade. The third shade disposed to block sunlight which passes through the optical member and reaches at least one of the holder and the power feeding member. The second reflector, the second shade and the third shade are parts of one-piece component formed of the same material.

5 Claims, 5 Drawing Sheets



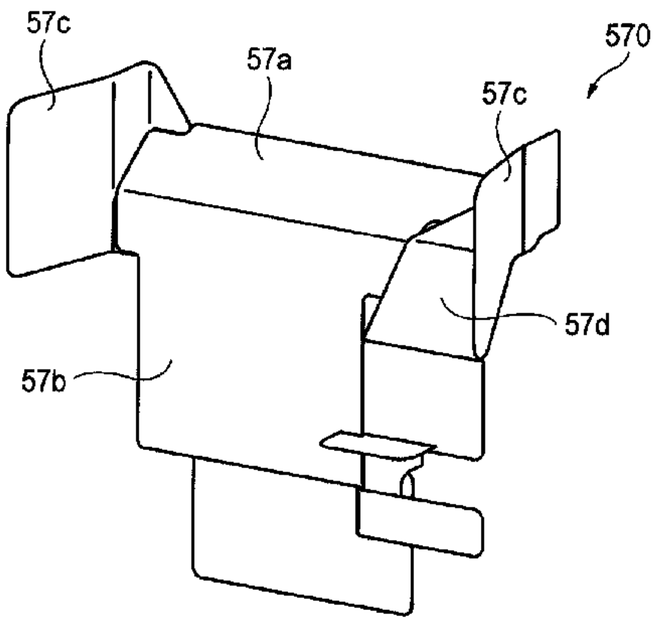


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FIG.1

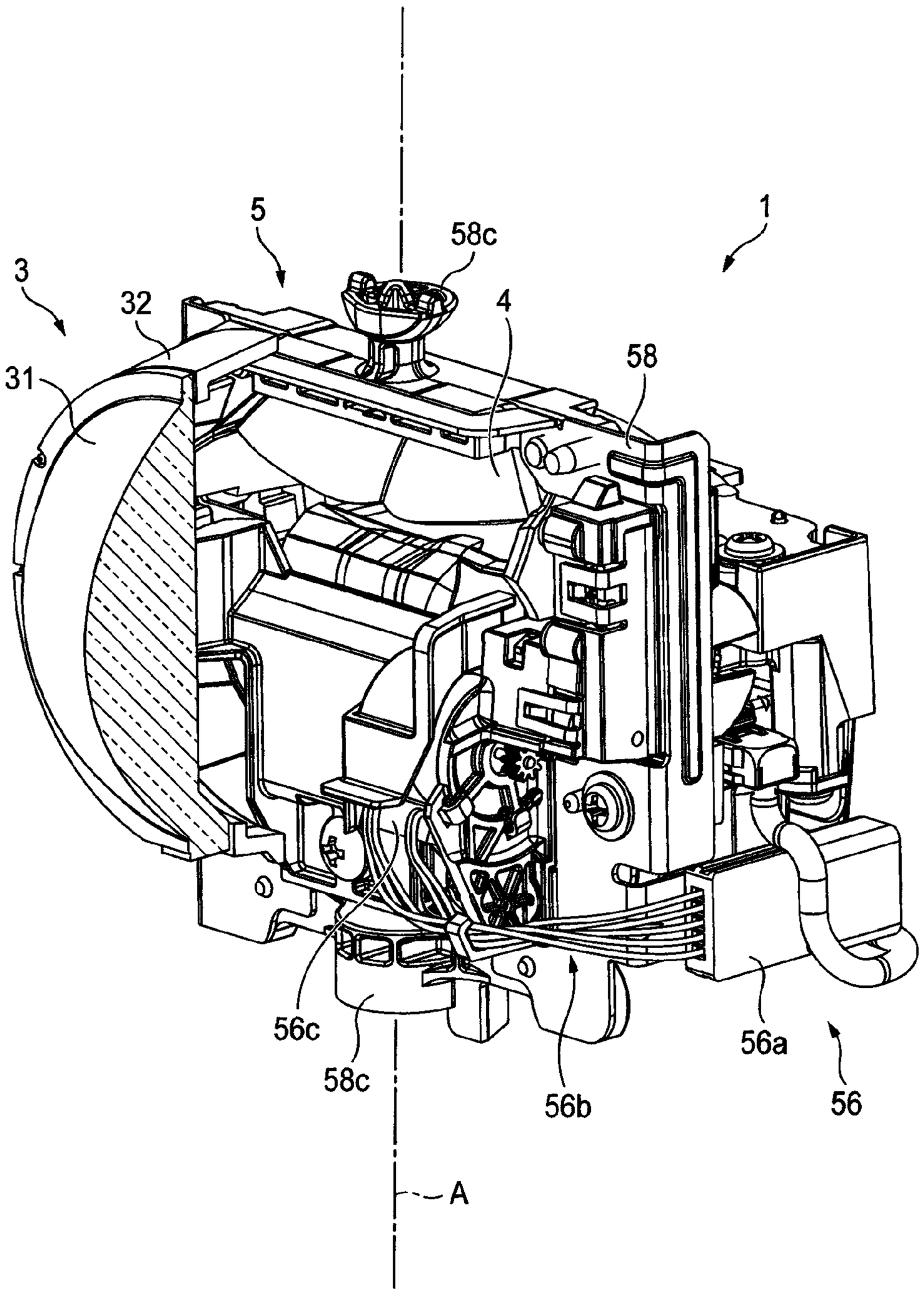
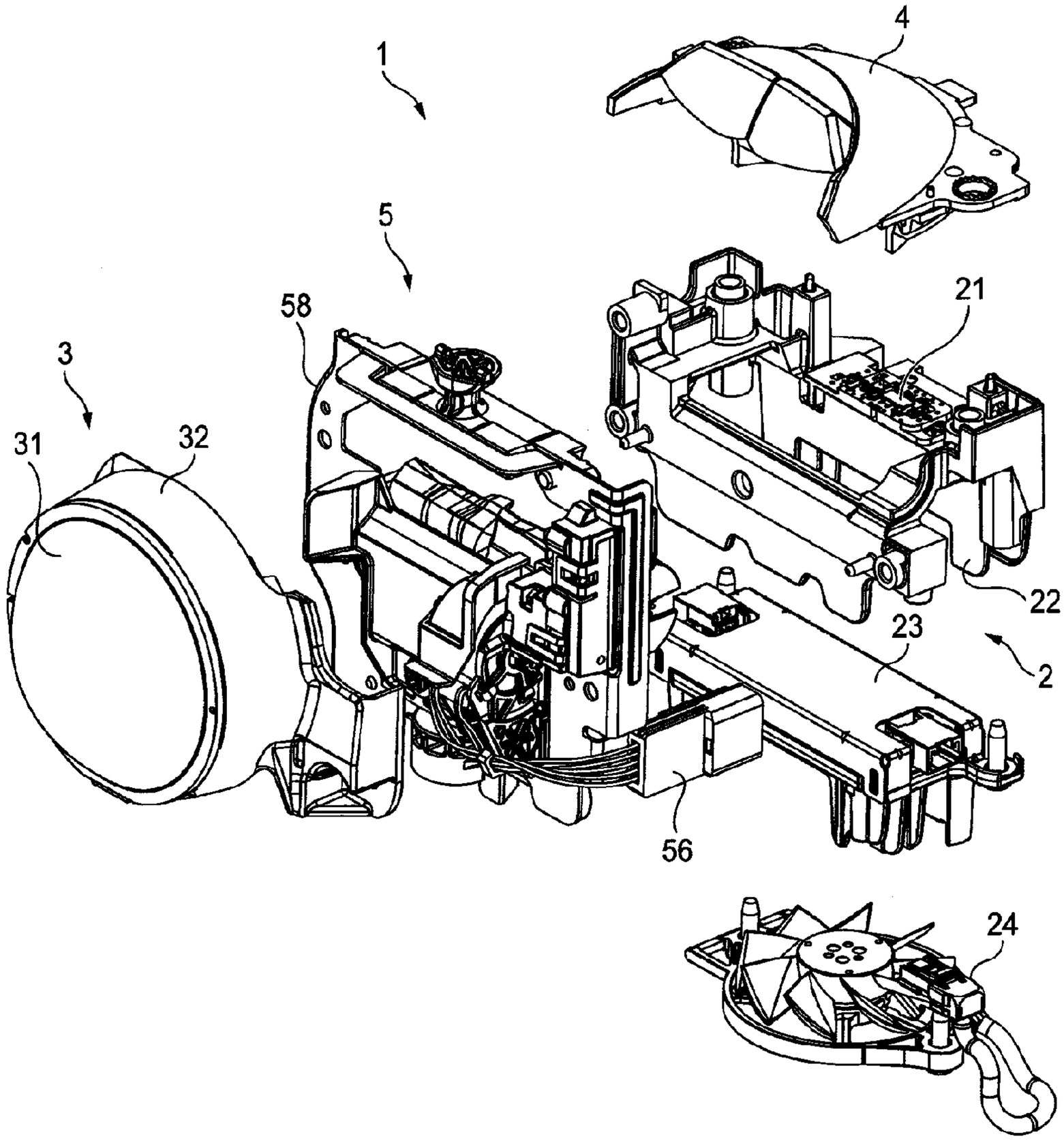


FIG.2



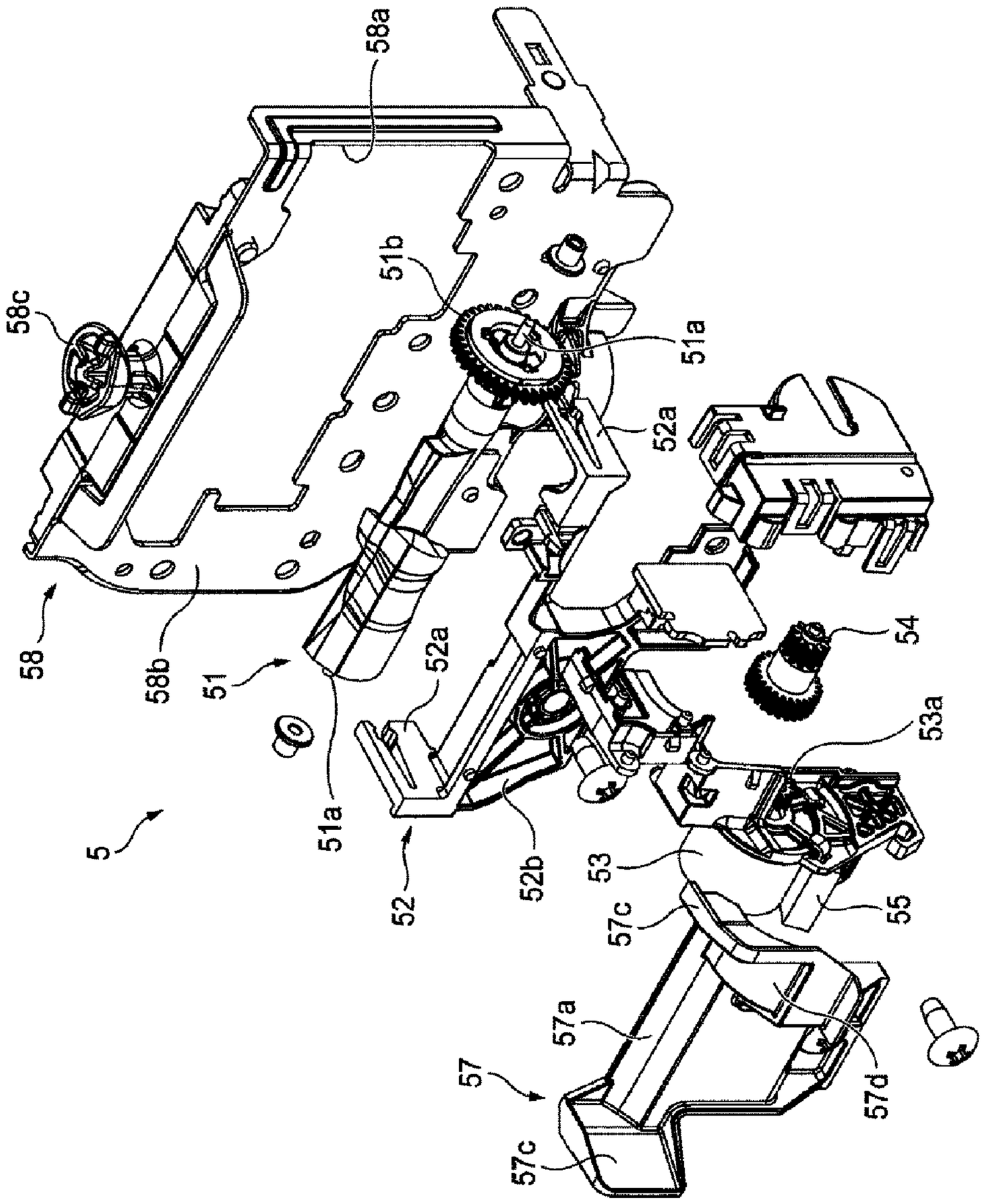

58a
58c
51b
51a
52a
58
58b
51
52a
54
53a
51a
52
52b
53
57c
55
57a
57
57c
57d

FIG.3

FIG.4A

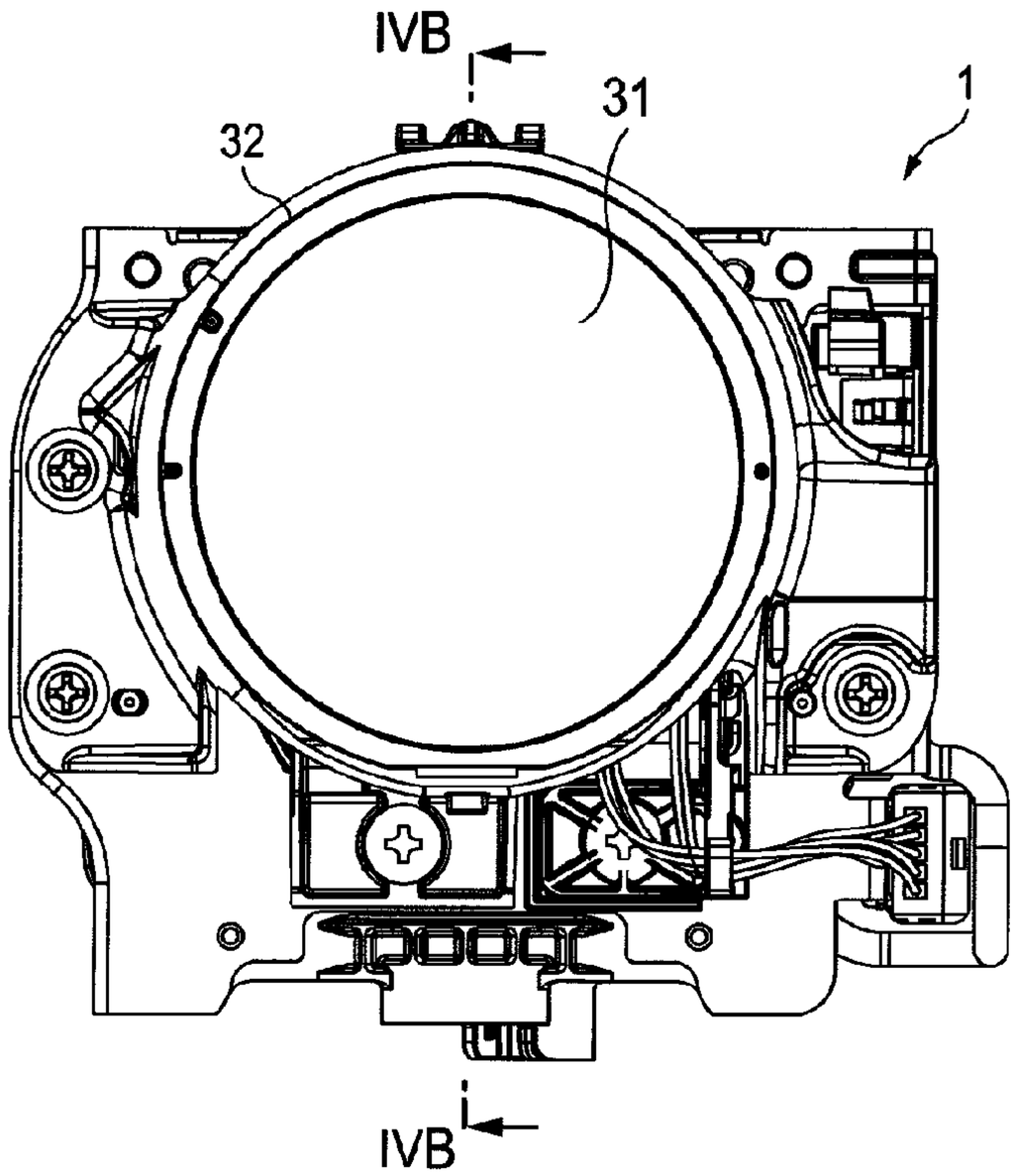
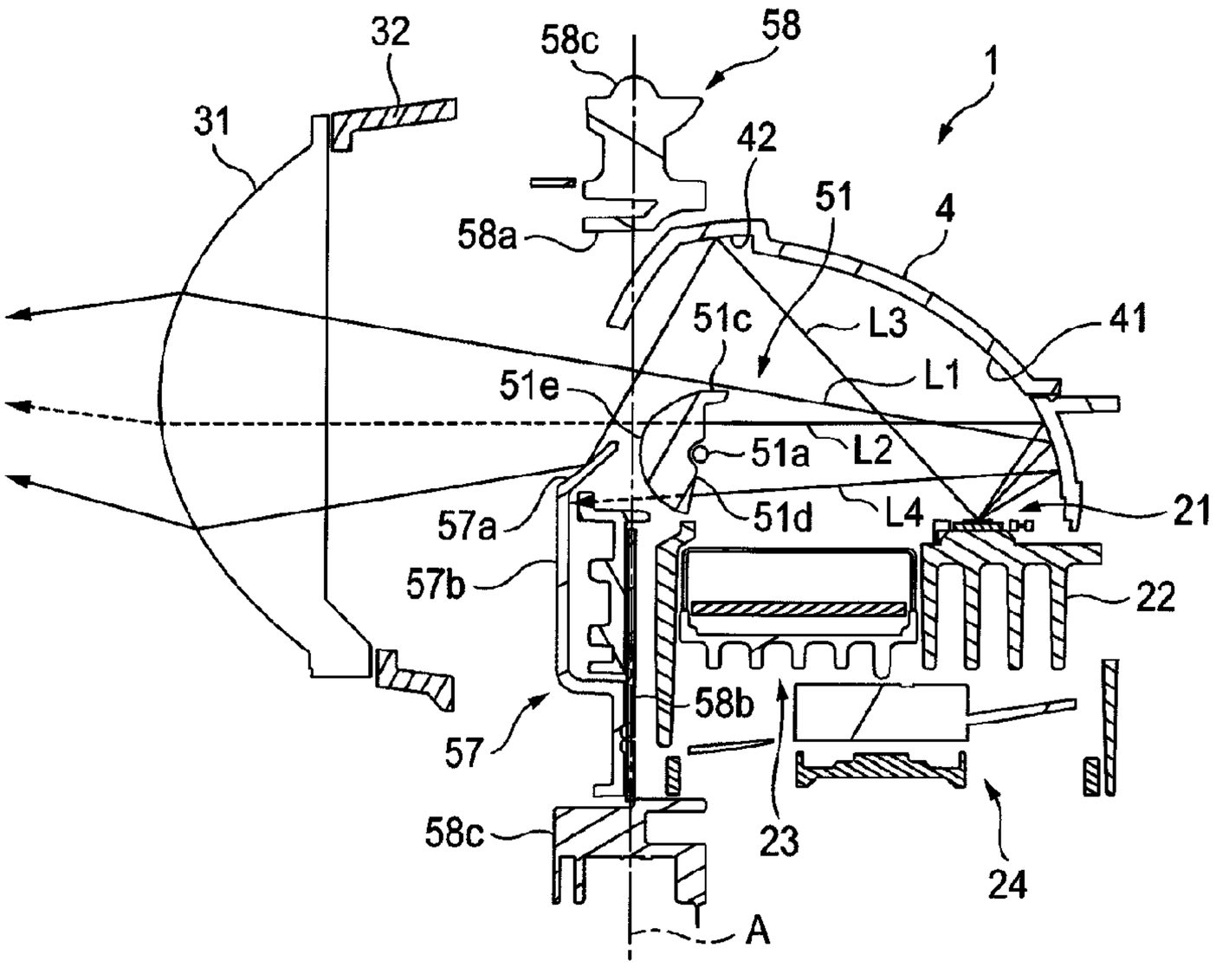

IVB
31
1
32
IVB

FIG.4B


32
58c
58
1
31
42
58a
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51c
L3
41
51e
L1
51a
L2
57a
51d
L4
21
57b
22
58b
57
58c
23
24
A

FIG.5A

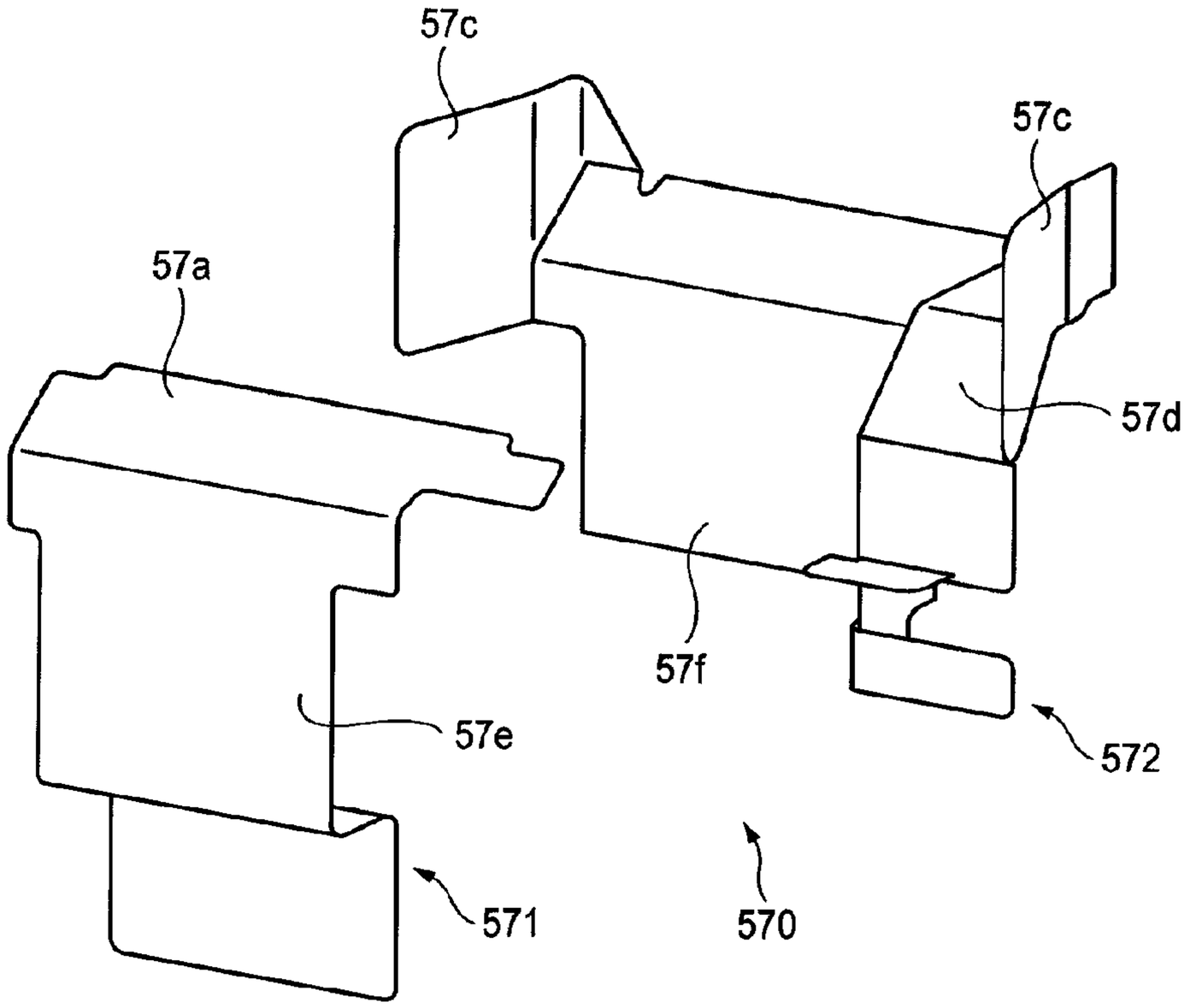
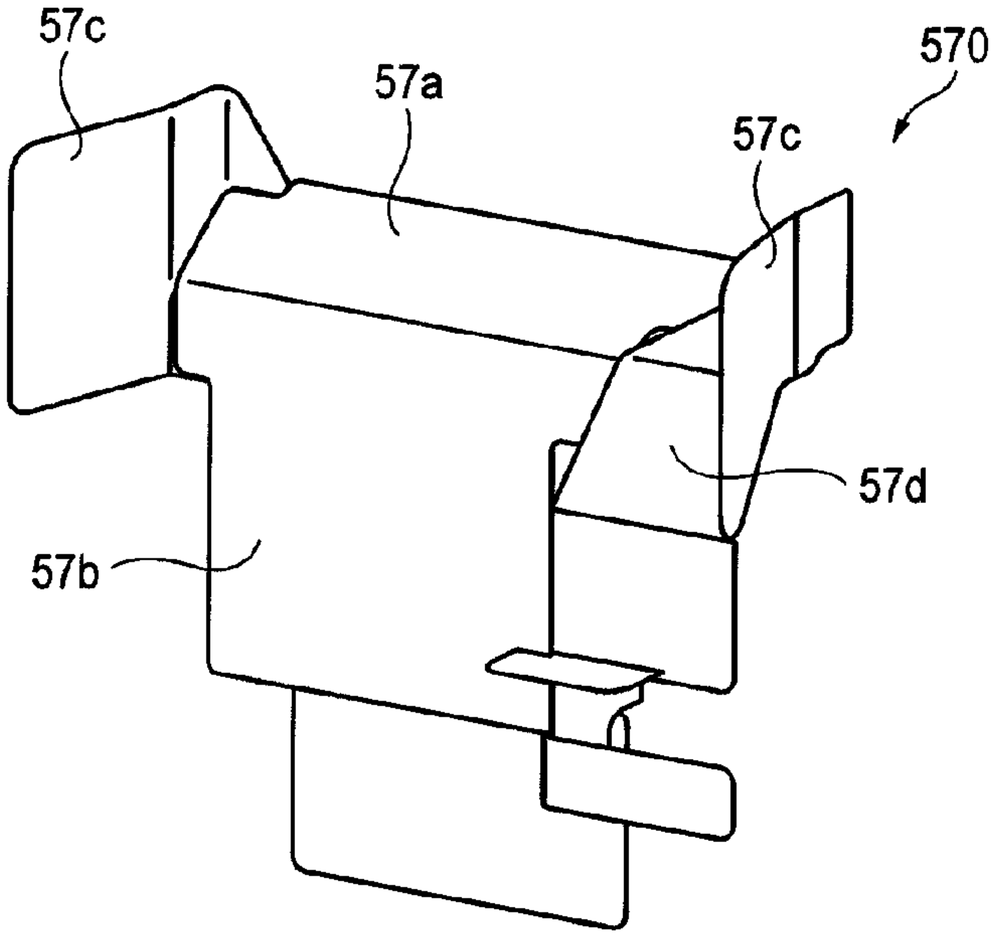


FIG.5B



ILLUMINATION DEVICE FOR VEHICLE HAVING ROTATABLE FIRST SHADE AND ONE PIECE COMPONENT WITH SHADES AND REFLECTOR DISPOSED IN FRONT OF FIRST SHADE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priorities from Japanese Patent Application No. 2015-117720 filed on Jun. 10, 2015, the entire contents of which are incorporated herein by reference.

FIELD

The present invention relates to an illumination device to be mounted on a vehicle.

BACKGROUND

An illumination device disclosed in Patent Document 1 includes a light source, an optical member, a rotary shade, a driving source and a power feeding member. The optical member irradiates light emitted from the light source in a predetermined direction. The rotary shade is disposed between the light source and the optical member. The rotary shade is configured to be able to block a part of the light emitted from the light source by being rotated about an axis. The driving source generates a force for rotating the rotary shade. The power feeding member supplies power to the driving source.

Patent Document 1: Japanese Patent Laid-Open Publication No. 2014-010969

As described above, the optical member is arranged so as to irradiate the light emitted from the light source in the predetermined direction. However, depending on a positional relationship between a vehicle and sun, sunlight may pass through the optical member and be focused in the illumination device. It is required to take measures for preventing the components of the illumination device from being damaged by the sunlight focused in this manner.

SUMMARY

The present invention aims to provide a configuration capable of preventing components of an illumination device from being damaged by the sunlight with low cost.

In order to achieve the above object, a first aspect of the present invention provides an illumination device to be mounted on a vehicle.

The illumination device includes:

a light source;

an optical member configured to irradiate light emitted from the light source in a predetermined direction;

a holder made of resin and configured to support the optical member;

a first reflector configured to reflect a part of the light emitted from the light source toward the optical member;

a first shade disposed between the light source and the optical member and capable of blocking a part of the light emitted from the light source by being rotated or pivoted about an axis;

a driving source configured to generate a force for rotating or pivoting the first shade;

a power feeding member made of resin and configured to supply power to the driving source;

a second reflector disposed between the optical member and the first shade and configured to reflect a part of the light reflected by the first reflector toward the optical member;

a second shade disposed between the optical member and the first shade so as to block a part of the light which is not blocked by the first shade; and

a third shade disposed to block sunlight which passes through the optical member and reaches at least one of the holder and the power feeding member,

in which the second reflector, the second shade and the third shade are parts of one-piece component formed of the same material.

As one-piece component integral with the second reflector or the second shade which is required to be placed between the optical member and the first shade, the third shade is provided for protecting resin components which are relatively susceptible to thermal damage. In this way, it is possible to provide a configuration capable of preventing the components of the illumination device from being damaged by the sunlight with low cost.

In order to achieve the above object, a second aspect of the present invention provides an illumination device to be mounted on a vehicle.

The illumination device includes:

a light source;

an optical member configured to irradiate light emitted from the light source in a predetermined direction;

a holder made of resin and configured to support the optical member;

a first reflector configured to reflect a part of the light emitted from the light source toward the optical member;

a first shade disposed between the light source and the optical member and capable of blocking a part of the light emitted from the light source by being rotated or pivoted about an axis;

a driving source configured to generate a force for rotating or pivoting the first shade;

a power feeding member made of resin and configured to supply power to the driving source;

a second reflector disposed between the optical member and the first shade and configured to reflect a part of the light reflected by the first reflector toward the optical member;

a second shade disposed between the optical member and the first shade so as to block a part of the light which is not blocked by the first shade; and

a third shade disposed to block sunlight which passes through the optical member and reaches at least one of the holder and the power feeding member,

in which the second reflector is a part of a first member formed of a first material,

in which at least one of the second shade and the third shade is a part of a second member formed of a second material different from the first material, and

in which the first member and the second member are integrated by a bonding.

According to this configuration, the first member mainly performing a reflector function is provided separately from the second member mainly performing a light-shielding function. In this way, a degree of freedom in selecting optimal material for each member is increased. For example, in a case where the first member is formed of a stainless material, there is no need to perform a surface treatment in order to obtain a stable reflecting surface. As a result, it is possible to provide a configuration capable of preventing the components of the illumination device from being damaged by the sunlight with lower cost.

The illumination device according to each aspect described above can be configured as follows.

The first shade is a rotary shade.

When the rotary shade in which it is theoretically difficult to avoid light leakage onto the optical member side is used as the first shade, effects of the second shade become prominent.

The illumination device according to each aspect described above can be configured as follows.

The illumination device includes a support member for supporting the holder, the first shade and the driving source, and

the support member has a portion disposed between the first shade and the second reflector.

That is, a shaft of the first shade and the second reflector are disposed on opposite sides across the support member. According to this configuration, it is possible to easily suppress an increase in size of a structure in a direction in which the first shade, the support member and the second reflector are arranged while ensuring a degree of freedom in shape selection and arrangement of the second reflector, as compared to a configuration in which both the shaft of the first shade and the second reflector are disposed in front of the support member.

In this case, the illumination device according to each aspect described above can be configured as follows.

The support member is pivotable about a swivel axis, and

the swivel axis extends between the first shade and the second reflector.

According to this configuration, a swivel control to change an irradiation direction of light passing through the optical member in a plane perpendicular to the swivel axis can be made.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a partial sectional perspective view showing an appearance of an illumination device according to an embodiment.

FIG. **2** is an exploded perspective view showing a configuration of the illumination device shown in FIG. **1**.

FIG. **3** is an exploded perspective view showing a configuration of a shade unit in the illumination device shown in FIG. **1**.

FIG. **4**A is a view showing a configuration of the illumination device shown in FIG. **1**.

FIG. **4**B is a sectional view taken along a line IVB-IVB in FIG. **4**A.

FIG. **5**A is a view showing another example of a multi-function member in the illumination device shown in FIG. **1**.

FIG. **5**B is a view showing another example of a multi-function member in the illumination device shown in FIG. **1**

DETAILED DESCRIPTION

Hereinafter, an illustrative embodiment will be described in detail with reference to the accompanying drawings. Meanwhile, in each of the drawings used in the following description, the scale of each member is suitably changed in order to have a recognizable size.

FIG. **1** is a partial sectional perspective view showing an appearance of an illumination device **1** according to an embodiment. FIG. **2** is an exploded perspective view showing a configuration of the illumination device **1**. For example, the illumination device **1** is a headlamp device to be mounted on a vehicle. As shown in FIGS. **1** and **2**, the illumination device **1** includes a light source unit **2**, a lens unit **3**, a reflector **4** and a shade unit **5**.

The light source unit **2** includes a light source **21**, a heat sink **22**, a drive control part **23** and an air-cooling fan **24**. As the light source **21**, a bulb light source such as an incandescent lamp and a halogen lamp, and a semiconductor light emitting element such as a light emitting diode, a laser diode an organic EL element can be suitably employed. The heat sink **22** supports the light source **21**. The heat sink **22** is formed of a high thermal conductive material such as a metal. The heat sink **22** dissipates heat caused by the light emission of the light source **21**. The drive control part **23** has a circuit which receives a control signal from an external control device (not shown) and controls the turn on/off of the light source **21**. The air-cooling fan **24** blows air to the heat sink **22**, thereby increasing the heat dissipation effect.

The lens unit **3** includes a projection lens **31** (an example of the optical member) and a lens holder **32** (an example of the holder). The projection lens **31** is formed of a translucent material. The projection lens **31** is configured so as to irradiate light emitted from the light source **21** in a predetermined direction. The lens holder **32** supports the projection lens **31**. The lens holder **32** is formed of resin.

The reflector **4** is fixed to the light source unit **2**. The reflector **4** is configured so as to reflect the light emitted from the light source **21** toward the projection lens **31**.

FIG. **3** is an exploded perspective view showing a configuration of the shade unit **5**. The shade unit **5** includes a rotary shade **51**, a bearing member **52**, a motor **53**, a transmission gear **54**, and a motor connector **55**.

The rotary shade **51** includes a rotation shaft **51***a* and an input gear **51***b*. The bearing member **52** includes a bearing arm portion **52***a*. The rotation shaft **51***a* is supported on the bearing arm portion **52***a* so as to be rotatable about the rotation shaft **51***a*. The motor **53** (an example of the driving source) includes an output shaft **53***a* mounted with a pinion gear. Rotation of the output shaft **53***a* is transmitted to the input gear **51***b* of the rotary shade **51** via the pinion gear and the transmission gear **54**. That is, the motor **53** generates a force for rotating the rotary shade **51**. The motor connector **55** (an example of the power feeding member) is provided for supplying power to drive the motor **53**. The motor connector **55** includes a housing made of resin.

As shown in FIGS. **1** and **2**, the shade unit **5** includes a power feeding connector **56** (an example of the power feeding member). The power feeding connector **56** includes a first housing **56***a*, a power feeding wire **56***b* and a second housing **56***c*. One end of the power feeding wire **56***b* is electrically connected to a terminal provided in the first housing **56***a*. The other end of the power feeding wire **56***b* is electrically connected to a terminal provided in the second housing **56***c*. The first housing **56***a* is connected to a mating connector (not shown) and receives a signal for controlling the driving of the motor **53**. The second housing **56***c* is connected to the motor connector **55**. The first housing **56***a*, an outer skin of the power feeding wire **56***b* and the second housing **56***c* are made of resin.

FIG. **4**A is a front view showing an appearance of the illumination device **1**. FIG. **4**B is a sectional view taken along a line IVB-IVB in FIG. **4**A.

The rotary shade **51** (an example of the first shade) is disposed between the light source **21** and the projection lens **31**. The rotary shade **51** has multiple kinds of end faces **51***c*, **51***d*, **51***e* which have different shapes depending on a circumferential angular position about the rotation shaft **51***a*.

The rotary shade **51** is configured to be able to block a part of the light emitted from the light source **21**.

For example, as shown in FIG. **4**B, when the end face **51***c* is disposed above, a light L**1** passing above the end face **51***c* reaches the projection lens **31** without being blocked by the rotary shade **51**. The light L**1** passing through the projection lens **31** forms, for example, a low-beam pattern in front of a vehicle. An end edge shape of the end face **51***c* is projected as a cut-off line in front of the vehicle. On the other hand, in such a state, a light L**2** is blocked by the rotary shade **51**. When the rotary shade **51** is rotated by the motor **53**, and hence, reaches a rotation angle position in which the end face **51***d* faces upward, the light L**2** reaches the projection lens **31** without being blocked by the rotary shade **51**, as shown in a broken line. The light L**2** passed through the projection lens **31** forms, for example, a portion of a high-beam pattern in front of the vehicle.

As shown in FIGS. **3** and **4**B, the shade unit **5** includes a multi-function member **57**. The multi-function member **57** includes an additional reflecting portion **57***a,* a leakage light shield portion **57***b,* a first sunlight shield portion **57***c* and a second sunlight shield portion **57***d* .

The reflector **4** (an example of the first reflector) has an additional reflecting surface **42** for reflecting a light L**3**, in addition to a reflecting surface **41** for reflecting the light L**1**, L**2** described above. The additional reflecting portion **57***a* (an example of the second reflector) is disposed between the projection lens **31** and the rotary shade **51**. The light L**3** (i.e., a part of the light emitted by the reflector **4**) reflected by the additional reflecting surface **42** is reflected toward the projection lens **31** by the additional reflecting portion **57***a.* The light L**3** passing through the projection lens **31** forms, for example, an additional light distribution pattern for overhead sign illumination in front of the vehicle. Here, the overhead sign means an indicator located above a head in a highway, etc.

The rotary shade **51** may have a rotation angle position in which it is theoretically difficult to avoid light leakage to the front. In an example shown in FIG. **4**B, when the rotary shade **51** is rotated, and hence, the end face **51***e* faces upward, a light L**4** emitted from the light source **21** passes below the end face **51***d* facing downward. The leakage light shield portion **57***b* (an example of the second shade) is disposed between the projection lens **31** and the shade **51** so as to block the light L**4** (i.e., a part of the light which is not blocked by the rotary shade **51**). In this way, the light leakage to the front is prevented, irrespective of the rotation angle position of the rotary shade **51**.

Depending on a positional relationship between the vehicle and sun, sunlight may pass through the projection lens **31** and be focused in the illumination device **1**. The first sunlight shield portion **57***c* (an example of the third shade) is disposed so as to block the sunlight which passes through the projection lens **31** and reaches the lens holder **35** by an internal reflection or the like. In this way, the lens holder **35** which is made of resin and is relatively susceptible to thermal damage can be protected from the sunlight focused. Further, the second sunlight shield portion **57***d* (an example of the third shade) is disposed so as to block the sunlight which passes through the projection lens **31** and reaches the motor connector **35** or the power feeding connector **56** by an internal reflection or the like. In this way, the motor connector **55** and the power feeding connector **56** which are made of resin and are relatively susceptible to thermal damage can be protected from the sunlight focused.

In the present embodiment, the additional reflecting portion **57***a,* the leakage light shield portion **57***b,* the first sunlight shield portion **57***c* and the second sunlight shield portion **57***d* are parts of the multi-function member **57** that is one-piece component formed of the same material. The multi-function member **57** is formed by, for example, a die-casting.

Also, in the present embodiment, as one-piece component integral with the additional reflecting portion **57***a* and the leakage light shield portion **57***b* which is required to be placed between the projection lens **31** and the rotary shade **51**, the first sunlight shield portion **57***c* and the second sunlight shield portion **57***d* are provided for protecting resin components which are relatively susceptible to thermal damage. In this way, it is possible to provide a configuration capable of preventing the components of the illumination device from being damaged by the sunlight with low cost.

FIG. **5**A shows a multi-function member **570** according to a modified example. The multi-function member **570** includes a first member **571** and a second member **572**. The first member **571** is formed of a stainless plate or a plated steel plate (an example of the first material). The first member **571** includes the additional reflecting portion **57***a* and a first joining portion **57***e.* The second member **572** is formed of a steel plate or an aluminum plate (an example of the second material). The second member **572** includes the first sunlight shield portion **57***c,* the second sunlight shield portion **57***d,* and a second joining portion **57***f.*

As shown in FIG. **5**B, the multi-function member **570** is integrally formed by joining the first member **571** and the second member **572**. Specifically, the first joining portion **57***e* of the first member **571** is joined to the second joining portion **57***f* of the second member **572**. The joining is performed by a welding, a fusing or a bonding, or by using a fastening member (caulking or rivet, etc.). The first joining portion **57***e* and the second joining portion **57***f,* which are joined, serve as the leakage light shield portion **57***b.*

Meanwhile, the portion serving as the leakage light shield portion **57***b* is not necessarily formed by both the first joining portion **57***e* and the second joining portion **57***f.* Only one of the first joining portion **57***e* and the second joining portion **57***f* may serve as the leakage light shield portion **57***b.*

Since the multi-function member **57** described above has a complicated shape, the multi-function member **57** is manufactured by a die-casting or the like. However, a surface treatment such as plating is required in order to stabilize the reflectivity of the additional reflecting portion **57***a.* In the case of the present modified example, the first member **571** mainly performing a reflector function is provided separately from the second member **572** mainly performing a light-shielding function. In this way, a degree of freedom in selecting optimal material for each member is improved. For example, in a case where the first member **571** is formed of a stainless material, there is no need to perform a surface treatment in order to obtain a stable reflecting surface. As a result, it is possible to provide a configuration capable of preventing the components of the illumination device from being damaged by the sunlight with lower cost.

As shown in FIGS. **1** to **4**, the illumination device **1** includes a support member **58**. The support member **58** has a plate portion **58***b* in which an opening **58***a* is formed. As shown in FIG. **3**, the bearing member **52** has a base portion **52***b.* The base portion **52***b* is mounted on a front surface (surface on the side facing the projection lens **31**) of the plate portion **58***b* of the support member **58**. At this time, the bearing arm portion **52***a,* on which the rotary shade **51** is rotatably supported, extends to the back side (side facing the light source **21**) through the opening **58***a* of the support member **58**. In this way, the rotary shade **51** is disposed on

the back side of the plate portion **58***b* of the support member **58**. The light source unit **2** is fixed to the back side of the plate portion **58***b*.

The motor **53** and the multi-function member **57** are mounted on the base portion **52***b* of the bearing member **52**. Thus, the motor **53** and the multi-function member **57** are supported by the support member **58**. Further, as shown in FIG. **1**, the lens holder **32** is mounted on the plate portion **58***b* of the support member **58**. Thus, the lens holder **32** is supported by the support member **58**. As a result, the plate portion **58***b* of the support member **58** is disposed between the rotary shade **51** and the additional reflecting portion **57***a*.

That is, the additional reflecting portion **57***a* and the shaft **51***a* of the rotary shade **51** are disposed on opposite sides across the plate portion **58***b* of the support member **58**. According to this configuration, it is possible to easily suppress an increase in size in the longitudinal direction of the illumination device **1** while ensuring a degree of freedom in shape selection and arrangement of the additional reflecting portion **57***a*, as compared to a configuration in which both the shaft **51***a* of the rotary shade **51** and the additional reflecting portion **57***a* are disposed in front of the plate portion **58***a*.

As shown in FIGS. **1**, **3** and **4**B, a swivel shaft portion **58***c* is provided at upper and lower ends of the plate portion **58***b* of the support member **58**. The support member **58** is pivotable about a swivel axis A passing through the swivel shaft portion **58***c* in a plane perpendicular to the swivel axis A. That is, the swivel axis A extends between the rotary shade **51** and the additional reflecting portion **57***a*. In this way, a swivel control to change an irradiation direction of light passing through the projection lens **31** in a lateral direction of a vehicle can be made.

The above embodiment is merely an example for facilitating the understanding of the present invention. The configurations according to the above embodiment can be suitably changed and modified without departing the gist of the present invention. Further, it is obvious that equivalents are included in the technical scope of the present invention.

The rotary shade **51** as an example of the first shade can be substituted with a shutter-type shade which switches a blocking state and a non-blocking state by being pivoted about a pivot axis. In this case, the motor as an example of the driving source can be substituted with an actuator using a solenoid or the like.

The projection lens **31** is not necessarily required to have a lens function. A scattering function or the like can be given to the projection lens, so long as a portion of the light emitted from the light source **21** can pass through the projection lens and can be irradiated in a predetermined direction.

In the multi-function member **57** or the multi-function member **570**, any one of the first sunlight shield portion **57***c* and the second sunlight shield portion **57***d* can be omitted depending on the specification of the illumination device **1**.

The invention claimed is:

1. An illumination device to be mounted on a vehicle comprising:

a light source;

an optical member configured to irradiate light emitted from the light source in a predetermined direction;

a holder made of resin and configured to support the optical member;

a first reflector configured to reflect a part of the light emitted from the light source toward the optical member;

a first shade disposed between the light source and the optical member and capable of blocking a part of the light emitted from the light source by being rotated or pivoted about an axis;

a driving source configured to generate a force for rotating or pivoting the first shade;

a power feeding member made of resin and configured to supply power to the driving source;

a second reflector disposed between the optical member and the first shade and configured to reflect a part of the light reflected by the first reflector toward the optical member;

a second shade disposed between the optical member and the first shade so as to block a part of the light which is not blocked by the first shade; and

a third shade disposed to block sunlight which passes through the optical member and reaches at least one of the holder and the power feeding member,

wherein the second reflector, the second shade and the third shade are parts of one-piece component formed of the same material.

2. An illumination device to be mounted on a vehicle comprising:

a light source;

an optical member configured to irradiate light emitted from the light source in a predetermined direction;

a holder made of resin and configured to support the optical member;

a first reflector configured to reflect a part of the light emitted from the light source toward the optical member;

a first shade disposed between the light source and the optical member and capable of blocking a part of the light emitted from the light source by being rotated or pivoted about an axis;

a driving source configured to generate a force for rotating or pivoting the first shade;

a power feeding member made of resin and configured to supply power to the driving source;

a second reflector disposed between the optical member and the first shade and configured to reflect a part of the light reflected by the first reflector toward the optical member;

a second shade disposed between the optical member and the first shade so as to block a part of the light which is not blocked by the first shade; and

a third shade disposed to block sunlight which passes through the optical member and reaches at least one of the holder and the power feeding member,

wherein the second reflector is a part of a first member formed of a first material,

wherein at least one of the second shade and the third shade is a part of a second member formed of a second material different from the first material, and

wherein the first member and the second member are integrated by a bonding.

3. The illumination device according to claim **1**,

wherein the first shade is a rotary shade.

4. The illumination device according to claim **1**,

wherein the illumination device further comprises a support member for supporting the holder, the first shade and the driving source, and

wherein the support member comprises a portion disposed between the first shade and the second reflector.

5. The illumination device according to claim **4**

wherein the support member is pivotable about a swivel axis, and

wherein the swivel axis extends between the first shade and the second reflector.

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